R E M A R K S

The claims under consideration in the case are 1, 4-28, 30, 31, 34, 36-49, and 69-75. Claims 50-68 remain withdrawn due to the Requirement for Restriction.

The Examiner is thanked for his guidance in telephonic discussions with the undersigned on July 8th and July 23rd regarding experiments to support the nonbviousness of the present claims.

Rejection under ' 103 over U.S. 4,228,297 in view of Grant et al.

Claims 1, 4-28, 30, 30, 34 and 36-49, and 69-75 are rejected under 35 U.S.C. ' 103(a) as obvious over Haeberli et al. (US 4,228,297) in view of Grant et al. (*Chemical Dictionary*, 1990, p. 11-12). Applicants respectfully request reconsideration and withdrawal of this rejection.

Claims 71-75 are directed to a one-step esterification process. Example 5 of the present Specification (Pages 45-46) Applicants' illustrates a one-step process of the present invention, in which the product had a purity of 94.84% by GC analysis. Haeberli et al. does not teach or suggest a one-step process for obtaining esterification products. Grant et al. does not teach processes for esterification.

As noted on Page 5 of the present Office Action, a difference between Haeberli et al. and the present claims is the use of glacial acetic acid in Haeberli et al. while the present case uses aqueous phosphoric acid to neutralize the catalyst. The Office Action further states that both phosphoric acid and acetic acid are well-known, citing Grant et al., and concludes that because acetic acid and phosphoric acid are both well-known, it is obvious to use one in place of the other. However, this overlooks the chemical differences of these two acids. Phosphoric acid is a strong acid, while acetic acid is a weak organic acid. Since acetic acid and phosphoric acid are quite different, there is no motivation to use phosphoric acid as an alternative to acetic acid. In addition, while the primary role of the acid is to neutralize the base (catalyst). The salts formed in the neutralization reaction

are desirably separated from the esterification product, and thus, a secondary consideration is the fate of the salt(s).

Regarding the neutralization step, in the presently claimed processes, aqueous phosphoric acid is added to the reaction mixture, which is stirred to ensure contact, and then water is removed from the mixture. Upon removal of water, a precipitate forms, which precipitate is the salt(s) formed in the neutralization reaction; the esterification product is a liquid. In contrast, in Haeberli et al., the catalyst is neutralized with acetic acid, and the esterification product is crystallized (precipitated) from a suitable solvent (column 9, lines 29-34). Crystallization of the esterification product in Haeberli et al. also serves to separate the acetate salts from the esterification product.

The Examiner has repeatedly asked for unexpected results. Similarly, the Examiner has also reiterated a suggestion to make a side-by-side comparison of the presently claimed invention to the process disclosed in Haeberli et al. To the extent possible, such a comparison has been made, as described in the Declaration accompanying this Response.

As can be seen from the results reported in the Declaration, for the experiment according to the present claims (paragraph 0007), the salts formed in the neutralization are separated from the esterification product (Declaration, Table 1). In contrast, no precipitate was formed in the experiment that followed the process of Example 1 of Haeberli et al., so the salts from the neutralization remained with the esterification product (Declaration, Table 1).

Further, the present Specification notes that phosphate salts are not soluble in hot adduct (esterification product; Page 23, paragraph 00077). This is borne out by the experiment according to the present claims in the Declaration, in which a precipitate was observed, and in which, after filtration, little potassium or phosphate was detected (Declaration, Table 1). Additional support for the successful separation of the phosphate salts from the hot esterification product is the observation that commercially-produced

products made according to the claimed process had an average potassium content of 14 ppm over a four-month period (Declaration, paragraph 9). In the processes of Haeberli et al., the acetate salts appear to be soluble in the hot esterification product since no precipitate formed, even after the ethanol, in which acetate salts are known to be soluble, was removed (Declaration, paragraph 6). However, at room temperature, the acetate salts did precipitate out of the product (an oil) over time (Declaration, Figure 1).

As suggested by the Examiner in a telephonic discussion with the undersigned, economic advantages of the presently claimed invention that can be quantified might also be relevant. The feature studied was the wash water needed when acetic acid is used according to present Example 7 (Declaration, paragraph 14). The conclusion was that the cost savings by not needing the wash water when using phosphoric acid was 12.4% (Declaration, paragraph 15). It was also noted that the presently claimed process is environmentally advantageous because it eliminates hazardous waste water that results from the water washes that are necessary when acetic acid is used, and therefore that another economic advantage of the presently claimed process is the avoidance of disposal costs for this waste water (Declaration, paragraph 16).

Additional economic benefits, at least some of which are a result of using aqueous phosphoric acid obtained by the processes of the present claims include:

- A precipitate is formed without need for addition of solvent or other reagents; thus the cost of such solvent(s) and/or reagent(s) is avoided. Haeberli et al. uses a large excess of ethyl alcohol, from which the esterification product is crystallized. More particularly, in Example 1 of Haeberli et al., the amount of ethanol (132 g) is 42.2% of the total weight of reagents used in the process therein. In the present case, Example 1 utilizes 34.7 g of water, which is only 4.4% of the total weight of reagents used in the process. Thus, the present invention provides a substantial reduction of solvent use and cost. Further, the reduction in solvent usage in turn allows the manufacture of more product in a particular reactor; in other words, more product can be produced per unit volume of reaction mass.
- There is a significant reduction in the amount of waste solids produced, greater

than 60% in comparison to prior processes. The claimed process typically generates waste solids on the order of between about 0.65% and 1.02% by weight, based on the phenol ester product; by comparison, other reported methods generate as much as 2.70% solids (Specification, Page 12, paragraph 00045). This translates into reduced costs for disposal of such solid waste.

- High yields of the esterification product are obtained. Applicants' Example 6 (Pages 46-47, paragraphs 000158-000165) shows a 97.4% isolated yield, based on 2,6-di-tert-butyl-phenol (the limiting reagent in Example 6). In this context, the highest isolated yield in Haeberli et al. is 87% (Example 3). Thus, more product can be produced while reducing material, energy, and waste disposal costs.

In this connection, a feature of the process in Haeberli et al. which has no equivalent in the processes of the present invention is the organic liquid waste produced by the neutralization/workup step. Haeberli et al. uses a large excess of ethyl alcohol in order to separate the salts of neutralization from the esterification product, and to isolate the esterification product as a solid. This results in the formation of organic waste composed of the recovered ethyl alcohol, which contains the salts from neutralized catalyst and lost product that did not crystallize out of the ethyl alcohol. The large amount of waste is both costly and an environmental issue. Specifically, it is again noted that in Example 1 of Haeberli et al., the amount of ethanol (132 g) is 42.2% of the total weight of reagents used in the process therein.

Neither the use of phosphoric acid nor the many advantages accruing therefrom are taught or suggested by the cited references. Nothing in Haeberli et al. suggests that there are any ill effects from the use of acetic acid, nor that there is any need for improvement in the process taught therein. Haeberli et al. does not contemplate or suggest any acid other than acetic acid.

Furthermore, it is submitted that the results of the experiment according to the present claims described in the Declaration and the economic advantages discussed above constitute unexpected results.

In light of the foregoing remarks, the case is believed to be in condition for allowance. Prompt notification to this effect would be sincerely appreciated.

If any matters remain that require further consideration, the Examiner is requested to telephone the undersigned at the number given below so that such matters may be discussed, and if possible, promptly resolved.

Please continue to address all correspondence in this Application to Albemarle Corporation at the address of record.

Respectfully submitted,

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